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**Rose, T.H. and McComb, A.J. (1995) *Recommendations for the future management and conservation of saltmarshes in the Peel-Harvey estuarine system. In: McComb, A.J., Kobryn, H.T. and Latchford, J.A. (eds) Samphire marshes of the Peel-Harvey estuarine system Western Australia. Peel Preservation Group and Murdoch University, Perth, Western Australia.***

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## **CHAPTER 7      *Recommendations for the future management and conservation of saltmarshes in the Peel-Harvey estuarine system***

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### **7.1 Introduction**

Estuarine saltmarshes can stimulate a number of senses. In a visual way, they provide a pleasing vista of procumbent to tall shrubs and trees tinged with colours ranging from red in autumn to succulent green in spring. This view is often enhanced by the sight of hundreds of wading birds feeding and dabbling along the shores and flying low over this interface between land and water. Saltmarshes also provide a contrasting sense when the rich productive smells of the marsh are detected. These smells are composed of decaying sun-baked vegetation mixing with the rotting gases of fetid muddy land. To some, the landscape features and the close proximity of open estuarine waters provides a potentially dollar-rich urban development challenge. With enough fill and re-contouring, these areas could be converted into expensive waterside homes. To all, however, the swarming mosquito hazes can drive us into our homes or cars making us wonder why nature has been so free in creating such a varied environment.

Overall, samphire marshes truly embody a large ecotone metaphor. On one side is a unique habitat providing an interface and link between land and water, and on the other side an environment fertile for human cultural conflict. Unfortunately, humans are an ecotone species and are drawn to the fringes of estuaries. To reduce conflict and successfully manage these environments requires an understanding of current land ownership, reserve status of fringing land, international treaty obligations, the planning process and the use of practical management plans and structures. It is also important to recognise the wisdom of using applied management and theoretical research plans to provide answers to management questions. They are most helpful if these plans recognise the uniqueness of most saltmarshes and give the public and estuarine manager the kind of information which allows saltmarshes to be conserved and sustained well into the future. Ultimately, any management plan must provide direction to help prevent the degradation of saltmarsh functions, such as ecologically important biodiversity, productivity and nutrient storage and release functions.

Successful management of saltmarshes also needs to recognise and plan for future pressures on these habitats. This pressure may be in the form of increased human usage from older industries such as peat mining and cattle grazing or from sunrise industries like ecotourism and permaculture. The source of such pressure can be simply attributed to the close proximity of our increasing and more concentrated human populations. In turn, increasing human proximity and pressure will require careful management of public health issues, because of the need to control mosquito borne diseases and for the potential for toxic water quality conditions to arise.

This chapter will outline issues for consideration and provide recommendations which the community, local authorities and state agencies will need to consider and hopefully implement, if the saltmarshes of the Peel-Harvey estuarine system are to be successfully conserved.

## **7.2 Recognising sources of degradation**

There are numerous sources of saltmarsh degradation but these can be divided into two major ones - natural and human/cultural sources.

### **7.2.1 *Natural sources***

Natural activities and impacts created by weather, animals and plants can change the characteristics of saltmarshes and therefore the susceptibility of the marsh to human degradation.

The saltmarshes located on the fringes of the basins and tributary rivers of the Peel-Harvey Estuary are dynamic environments which undergo seasonal and yearly changes. Estuaries are "ephemeral" environments and can last, in a geological sense, between several and 20-40 thousand years (Barnes, 1974). The result is that each saltmarsh can reflect three basic stages or states of development and maturation, depending on processes determined by geology, the age of the estuary and human activity in its catchment. For example, saltmarshes can be accreting or growing; they can be eroding and either be becoming permanently submerged or disappearing as higher elevation terrestrial plant communities are established; or lastly, the marsh may be in relative stasis, with an equal proportion of low and higher elevation plant communities. This means that nature ultimately determines the longevity of marshes and the uniqueness of its animal and plant diversity and structure and ecological functions. Nature strongly influences the propensity for a marsh to become

degraded or be resistant to human impacts, through its overall control of tidal activity, rainfall, hydrology, river flooding and wind, storm and biological patterns.

### **7.2.2 Human sources**

#### ***Grazing***

Historically, the saltmarshes of the Peel-Harvey have been grazed by sheep and cattle. Marshes often provided the only source of late summer and autumn fodder, particularly in dry hot years and where cattle and sheep owners possessed high water titles to their land. Grazing activity was prevalent in the Creery and Harvey Estuary marshes (O.H. Tuckey, pers. comm.). The result is that many of the saltmarshes found around the fringe of the estuary have been and are still influenced by cattle and sheep grazing which affects plant and animal species diversity, the historical productivity of the marsh and its long term accretion/erosion patterns (Adam, 1993).

#### ***Hunting***

Until recently, duck hunting was legal, and this strongly influenced the numbers and species diversity in saltmarshes (Adam, 1993; M. Bamford, pers. comm.). Since duck hunting ended in the late 1980s, duck numbers and diversity appear to have increased (M. Bamford, pers. comm. and T. Rose, pers. observ.). The hunting of kangaroos and other mammals has also influenced the number and diversity of natural marsh grazers, and therefore their impact on and use of the saltmarsh. Hunting can reduce the numbers of, and even eliminate common members of the fauna in saltmarshes, so affecting overall biodiversity and natural grazing patterns.

#### ***Feral animals and weeds***

Human settlement has introduced feral animals such as rabbits, cats, foxes and bees into the saltmarshes of the region. European use of saltmarshes, in the main, has also introduced weeds and non-native plants. For example, *Watsonia*, bull rushes and grasses are now common components of the plant communities in most marshes. Weeds have flourished because of altered water tables due to nearby human settlement and land uses (such as irrigation and clearing). They have also flourished because of fire events which generally have not been favourable to a wide range of native plants. If fire patterns mimic more natural patterns in terms of frequency and intensity, then a wider variety of native plants

is able to compete with introduced plants and weeds (Pen, 1987). The consequences of feral invasions are that marshes become altered in structure, productivity and nutrient functions. These alterations affect other estuarine flora and fauna, including native birds and other animals.

### ***Direct human use and access***

In the past, horses and bridal trails have degraded samphire marshes. However more recently, particularly in the last fifty years, human access and use of vehicles, notably four-wheel drive vehicles and trail bikes, have degraded saltmarshes through the creation of wheel ruts, destroyed vegetation and allowed rubbish to be deposited directly in these environments. Vehicle access has allowed entry to previously isolated areas and provided opportunities for trees to be cut down or used for fuel. The creation and construction of roads and trails, both sealed and unsealed, has led to the fragmentation of once very extensive and continuous saltmarshes in the region, for example the Creery wetlands. This kind of degradation, that is slow fragmentation, has been documented in Chapter Two and affects marshes by altering hydrology, their ability to resist erosion, the processing and export of nutrients and the provision of habitat integrity which a variety of plants and animals require to persist in this habitat. The end result is a breakdown in ecological function and therefore in their importance to the Peel-Harvey estuarine ecosystem.

### ***Human infilling***

Infilling has been one of the most common ways by which saltmarshes have been lost in the Peel region. To secure land from the effects of regular and occasional flooding, humans have used the importation of sedimentary fill to raise the level of the land. Infilling immediately smothers and eliminates saltmarsh. It has been the primary method which has allowed the City of Mandurah to develop around the Mandurah Entrance Channel. Infilling is also prevalent in the lower reaches of the Serpentine River and at Yunderup Canals, on the eastern fringe of the Peel Inlet, where further stages of urban development are occurring. In addition to the immediate impacts of fill, a lot of fill contains weeds or weed seeds, and sets in train the invasion of saltmarshes with exotics with consequent long term degradation. In summary, infilling causes a loss of vegetation and can alter groundwater hydrology patterns, which may lead to de-stabilisation of marsh communities.

### **7.3. Considerations for management**

The difficulty of managing saltmarshes in a regional or ecosystem context is that several strategic political and financial steps need to be taken at the same time in order to effectively conserve this environment. Co-ordinating synchrony can be very difficult without a unified community and political recognition of the need to conserve samphires and the will to do so. Co-ordinating cultural and political will must be combined with the co-ordination of various government bodies that can influence the conservation of these environments. The provision of financial resources is also necessary to fulfil the following recommendations.

#### ***7.3.1 Strategic Steps***

The preparation of a comprehensive inventory of the location, number and extent of saltmarsh habitats would be a helpful first step. Chapter Two is very helpful in that it has identified current locations of saltmarshes as well as historical trends in saltmarsh habitat area, whether they are expanding or contracting. This inventory would need to be combined with the defunct Department of Conservation and Environment Red Book (1983) recommendations. Finally, an on-the-ground site assessment for "health" and conservation value of existing saltmarsh habitats is needed. This survey could categorise all samphire wetlands into conservation value and would complement or update the Red Book (1983). The combination of the three documents into an integrated resource document, a resource catalogue, would provide the basis for several further steps. However, to minimise controversy over boundaries which define the location and area of conservation areas, the catalogue needs high quality maps, be surveyed as accurately as possible and follow prescribed objective procedures which can be easily replicated.

Other means of conserving samphire marshes are as follows:

1. The creation of an Environmental Protection Policy (EPP) for samphire-dominated saltmarshes in the Peel Region, which could perhaps extend over the whole Swan Coastal Plain. This EPP could be a subsection of the current EPP for Wetlands of the Swan Coastal Plain. Only the Environmental Protection Authority, through the Department of Environmental Protection, can underwrite such legislation and undertake the extensive public consultation required for a regional policy. The EPP would identify areas requiring high conservation and set a target or minimum surface area for saltmarsh habitat which could not be exceeded or lost in the region. This should be based on the preceding resource inventory catalogue.

2. Integrate identified saltmarsh worthy of conservation, based on a minimum functional size into the Peel Regional Plan and Park (particularly into a regional structure plan). This should be combined with recognition for RAMSAR, CAMBA and JAMBA areas. Any areas identified for bird treaties must be clearly outlined and marked on maps, and recognised by all interests which can potentially affect their future. It would be expected that following establishment of the Peel Regional Park, the saltmarshes identified for acquisition and conservation would be included in its management boundaries.

3. The Peel Regional Strategy (formerly Peel Regional Plan) must set the framework for the establishment of an acquisition fund which would provide funds for acquiring privately-held land containing significant saltmarsh with conservation potential. This fund would need to be based on similar principles to the Perth Metropolitan Region Improvement Fund (MRIF) administered by the WA Planning Commission. This fund could also acquire land for public amenity, buffer purposes, vegetation and wildlife corridors and foreshore reserves, all of which would help reduce pressure on fringing areas of the estuary with saltmarsh.

4. Recognise and implement the recommendations in the Peel Inlet Management Authority Management Programme (Waterways Commission, 1992), which has identified a Waterways Protection Precinct. For example, the Programme recommends the retention and conservation of significant portions of the Creery Wetlands, Entrance Channel samphire areas, Austin Bay, Roberts Bay and large portions of the fringing land in the southern Harvey Estuary. Overall, this Programme recognises the need to conserve and maintain saltmarshes within the Peel Inlet Management Authority's Management Boundary and should be used as a *minimum* protection document for saltmarshes. Furthermore, the Programme is supported by several regional management plans (e.g. Western Foreshore Management Plan and Draft Eastern Foreshore Management Plan) which aim to help consolidate smaller fringing saltmarshes into more functional foreshore reserves and have identified the most appropriate vestees or managers of this land. The term *minimum* is used because many saltmarshes were assessed in the late 1980s while the Programme was being developed. The recovery and improvement in habitat value of saltmarshes previously classified as degraded may be considerable and thus make some of the Programme's recommendations outdated.

5. Incorporation of saltmarsh areas found in close proximity or adjacent to current Department of Conservation and Land Management A and B Class Reserves should be encouraged. Adequate funding for these reserves also needs to be addressed once these areas are reserved.

6. Inclusion of conservation marshes with recognised conservation values and/or significant portions of fringing saltmarsh habitat into local authority town planning schemes (TPS) would be a very strategic move. Inclusion can occur either through reservation or through adoption of landscape and special environment zones which are clearly recognised in the new TPS. These steps would be most relevant for the City of Mandurah and Shire of Murray, but have some relevance for the Shires of Jarrahdale-Serpentine and Waroona and the City of Rockingham.

The use of the Town Planning and structure planning procedures (see glossary) is critical to laying the foundations for the future conservation of the Peel-Harvey saltmarshes. Legal instruments such as by-law legislation in Town Planning Schemes can provide for penalties, and scheduling clearly defined conforming and non-conforming uses can lay the legal foundation for future use and conservation of these critical habitats. Furthermore, the ceding of land free of charge to the Crown under the Town Planning Act of 1928 is a further method of securing portions of saltmarshes. However, to use this method it must be pre-planned, broadly advertised to all development parties, and based on the provision of public or Crown access around the fringe of the estuary, as well as providing recreation and conservation uses. The concept of ceding land and foreshores for strictly conservation purposes needs to be explicitly supported by the WA Planning Commission.

7. Determine up-to-date community attitudes to saltmarshes and the potential for future ecotourism and other sustainable industries which will use saltmarshes. These studies need to be tightly linked to tourism and development plans and strategies. They would fit best as components of the Peel Regional Plan. Such studies need to be rigorously designed and defensible and would probably be best conducted by qualified university and professional firms. The results of these surveys and polls would lay the basis for educational programs and identify target groups that need to be reached. None of the above steps are



likely to succeed if society's perceptions of saltmarshes remains in continuing to perceive them as worthless habitats best filled in and developed.

### ***7.3 2 Immediate strategic suggestions for conserving saltmarshes***

While the above strategic steps should be implemented to plan for the "long term" strategic conservation of saltmarsh of the Peel-Harvey Estuary, the studies in this report strongly suggest that several areas could be immediately gazetted for conservation purposes (see previous Point Four above). Chapter Two strongly suggests that moves should be made to reserve and immediately manage the following ecologically significant areas:

- the Goegrup Lakes system on the Serpentine River,
- all of the remaining Creery Wetlands,
- southern Peel Inlet adjacent to Austin and Robert Bays,
- the southern area of the Harvey Estuary, that is area south of Island and Herron Point across to the Harvey River, including its delta.

The last area, in addition to the Goegrup Lakes system, has already been targeted for inclusion into a park. However, the process needs to be expedited urgently. The urgency is based on the fact that development is encroaching quickly upon these areas, and there is increasing unmanaged access to and use of the areas. This is contributing to their degradation and threatening their ecological function.

### ***7.3.3 Practical considerations - the use of plans as a basis for management***

The management of reserves, particularly saltmarshes, is usually done by using formal management plans. They are most effective when a saltmarsh has been clearly gazetted for conservation or as a multiple-use park. Management plans have a greater chance of success if they are applied to functional saltmarsh units and not to those which have been fragmented and cut into halves or quarters because of arbitrary planning and decision making processes. Managing saltmarshes which have been fragmented, have altered hydrology characteristics and are becoming degraded is difficult because the resource often changes more quickly than the best adaptive management plan.

Applied management plans need to have some of the following components:

### ***Foreshore Management plans***

#### ***(Structure plans)***

These can identify the most appropriate location for fences, access points, trails and roads, boardwalks, education and information boards and centres, parking facilities, toilets and maintenance and administrative structures if necessary. The inclusion of generic or specific construction standards as well as specific survey results are also helpful.

#### ***Fencing requirements***

Fences help prevent urban encroachment, define the saltmarsh, keep out feral animals and can be modified when they articulate with vegetation corridors to allow wildlife to pass.

#### ***Weed control and eradication***

The identification of weeds and the mapping of weed locations is essential for weed management. Outlining management options to control them is also essential. For example, fire control, manual and mechanical removal methods, herbicide and biological control are all part of such a strategy.

#### ***Feral animals***

Identification of the type and the scale of feral animal problems is necessary. An adaptive trapping or control program needs to be outlined.

#### ***Fire management***

This is critical from both a general safety and biodiversity point of view. The use of fire needs to be planned so that low fuel buffers are found around structures, threats of wildfire spreading to surrounding developments are minimised, and that a mosaic of fire treatments is provided. These mosaics will need to vary in fire intensity, from cool to hot, and in terms of seasonality, during spring, summer or autumn. They will also need to vary in their frequency, once every set period of years. Maintaining mosaics will help to provide a variety of habitat

conditions which allow a wide variety of plants to flourish, contribute to and help maintain the seed bank in the ground.

### ***Inventories of land capability, plant and animal communities***

These provide the basis for understanding the physical and biological resources in each specific saltmarsh and outline major management considerations.

### ***Public Health concerns***

Identification of nuisance animals and plants and their management in relation to the specific marsh is necessary. Management methods to control mosquitoes should identify appropriate biological, chemical and mechanical controls, such as runnelling or ditching (Plate 7.1).

### ***Time scale changes***

This allows the manager to understand changes which may occur over different time scales and which will affect the natural resources of the saltmarsh. For example, awareness of seasonal changes, public use periods and changes in long term tide and weather patterns. Consideration for the long term effects that the Dawesville Channel will have on marshes will also be necessary. One prediction is that there may be a slow march of fringing vegetation out into the estuary, similar to that which has occurred in Leschenault Inlet since it was opened to the ocean in 1951 (L. Pen, pers. comm.).

### ***Public expectations of management and access***

Provision for local community management committees may be both necessary and desirable. Consideration of how decisions will be made as well as how people wish to utilise the marsh is necessary, and this component needs to be carefully included in any management plan.

### ***Inclusion of a research plan***

A list of management questions, and questions about marsh biology and ecology, which can be answered by research will facilitate the development of appropriate management methods, and allow management to be responsive and adaptive to community concerns and changes in resource status, for example shrinking cover or the health of specific plant species.



Plate 7.1 Runnels, a physical mosquito control technique connect saltmarsh pans to the estuary, allowing the exchange of water. The top photograph displays the runnel, which is a spoon shaped channel, and in the bottom photograph water from the estuary is entering the pan via the runnel.

## **7.4 Research Plans**

These plans provide for a more rigorous and methodical way of testing management tools and reviewing the biological, chemical and physical components as well as the higher order nutrient and productivity processes of the saltmarsh. The results of such research need to be disseminated at an appropriate level so that they provide the saltmarsh manager with viable and responsible alternatives to the management methods and tools used at present. Research plans can have a strong scientific component or be dominated by more applied research questions and issues.

### ***7.4.1 Scientific plans***

The preceding chapters have stimulated a number of scientific questions which could be addressed in a comprehensive manner with a properly financed research budget. These include the compilation of comprehensive species lists for plants and animals in the saltmarsh (including dry and wet phases), a measure of their density and biomass and the daily, seasonal and spatial changes which occur for both individual species and their communities. In summary, qualitative and quantitative surveys of the biota over various temporal and spatial scales are needed. Studies on establishment characteristics of native and weed plant species would be helpful. Research which measures natural and feral grazing pressure would also be very valuable.

Aside from the above biological and ecological questions, important information could be gathered from studying soil chemistry, particularly with regard to nutrient exchange and flux. Understanding how inundation by salt and fresh water and for varying periods affects chemistry is very important from an overall ecosystem perspective. Related to this direction of study are questions on plant nutrition and their uptake of nutrients.

Finally, higher order research into processes and function is critical to strategic management of saltmarshes. For example, investigating mechanisms for importing and exporting nutrients and organic matter is essential. Such research needs to also include the effect of spatial and temporal factors on these processes.

#### ***7.4.2 Applied management research***

Applied research should investigate a range of tools used in the management plan. For example, investigating the effect of trail and fence locations and determining the best time to rotate these or if it is even necessary. Methodical investigation of access and the best kinds of fencing and surface treatment of trails are also examples of this kind of research. Perhaps the most important are investigations and monitoring of fire treatments and their impact on the vegetation community. This could include investigating the seed bank and determining recovery potential of various areas of the marsh. Reviewing and monitoring runnels (Plate 7.1) or ditches for mosquito control and impact on vegetation and birds would also be very important. Ultimately, research would need to look at resistance of mosquitoes to current use of larvicides as well as biological controls.

Much of applied research could be included in regular monitoring of the marsh vegetation and fauna community and the format for such monitoring to allow the manager to be adaptive and responsive to changes. Monitoring in its various forms would include overseeing the impact of ecotourism and making sure related access and use do not detrimentally impact upon the saltmarsh environment. Applied research could also examine the feasibility and success of regenerating or rehabilitating degraded marsh.

#### **7.5 Conclusion**

Degradation of saltmarshes occurs on a number of different spatial and time scales. Both natural and human assisted disturbances of the saltmarsh can vary in time from the very short to decades. Nature contributes an underlying source of "degradation" and change. This usually occurs on a relatively slow scale but storm events can occur on very short scales. Unfortunately, human activity in the saltmarsh is often chronic and occurs over a long time. Human degradation can also occur in pulses, such as during prawning and fishing seasons. In either form this degradation can occur over a significant area.

Many of the above recommendations and ideas need to be implemented by a few key organisations. Because of the value of saltmarshes to the Peel-Harvey Estuary and the fact that the Peel Inlet Management Authority is a public statutory body with a line management structure and function with extensive foreshore management plans, the majority of co-ordination could be done by this

organisation. To a lesser extent, some of the work would also need to be done by the Department of Conservation and Land Management, with its role in the management of reserves and other related categories of land. However, critical further work would need to be done by Local Authorities on their Town Planning Schemes and by the Conservation Council of Western Australia to maintain political momentum. All of these organisations could be strategically directed by an EPA Environmental Protection Policy on saltmarshes with significant assistance provided by the WA Planning Commission. The Planning Commission could produce guidelines to advise developers of the sensitivity of samphire marshes and the manner in which to develop in the vicinity of them in a sustainable way.

The conservation and preservation of saltmarshes in the Peel-Harvey region cannot be simply based on the argument that wetlands should *just be conserved*. This simplistic approach will be unsuccessful without demonstrating and proving the benefits of such a policy or proposing alternative ways of meeting community needs (Adam, 1993). Educating the community and decision makers on the very valuable role that saltmarshes perform for the environment and for the economy will be critical. Understanding the insidious role of *the tyranny of small decisions*, which defines the process coined by Adam in the mid 1980s as that of approving small incremental losses without understanding the cumulative impact this has on ecosystems and how this has eroded and degraded many saltmarshes in the region, needs to be squarely faced and understood. Reliance on mitigation procedures to sacrifice relatively functional or recovering saltmarshes for artificial or "quartered" habitats is a poor alternative. Overseas experience has shown that this rarely works unless a degraded area is returned to functionality.

The eventual fate of saltmarshes in the Peel-Harvey will be heavily influenced by the effects of the Dawesville Channel. This channel will influence the expansion or contraction of this habitat and will require managers and the public to realise that the eventual direction of change will be determined after decades of monitoring and will require flexibility in saltmarsh management.

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